IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application. An identifier indicating the status of each claim is provided.

Listing of Claims

1. (currently amended) An additional information embedding method for embedding additional information into an audio signal, the method comprising:

an orthogonal transform step of orthogonally transforming an audio signal and thus calculating an orthogonal transform coefficient; and

a shift and addition step of damping and shifting the orthogonal transform coefficient in the direction of the frequency axis and adding ~~the resultant coefficient~~ additional information to the original orthogonal transform coefficient, ~~so as to embed the additional information~~

wherein the shift step and addition step generates the additional information by performing inverse orthogonal transform to a predetermined number of orthogonal transform coefficient.

2. (currently amended) The additional information embedding method as claimed in claim 1, wherein the orthogonal transform step includes carrying out MDCT of the audio signal so as to calculate an MDCT coefficient, and wherein the shift and addition step includes damping and shifting the calculated MDCT coefficient in the direction of the frequency axis and adding the ~~resultant coefficient~~additional information to the original MDCT coefficient so as to embed the additional information.

3. (original) The additional information embedding method as claimed in claim 1, wherein the shift and addition step includes adding the orthogonal transform coefficient shifted on the frequency axis to the original orthogonal transform coefficient so that a frequency masking condition and a temporal masking condition are met.

4. (original) The additional information embedding method as claimed in claim 1, wherein the shift and addition step includes carrying out the addition when the value obtained by adding the shifted orthogonal transform coefficient to the value of the original orthogonal transform coefficient is not higher than a predetermined value.

5. (original) The additional information embedding method as claimed in claim 1, wherein the shift and addition step includes prohibiting the shift and addition in accordance with the polarity of the value obtained by adding the shifted orthogonal transform coefficient to the value of the original orthogonal transform coefficient.

6. (original) The additional information embedding method as claimed in claim 1, wherein the shift and addition step includes carrying out the shift and addition when the audio signal falls within a range from an upper limit value to a lower limit value.

7. (original) The additional information embedding method as claimed in claim 6, wherein the shift and addition step includes carrying out the shift and addition when the audio signal falls within a range from an upper limit value to a lower limit value set on the basis of the human auditory characteristics.

8. (original) The additional information embedding method as claimed in claim 1, wherein the shift and addition step includes carrying out the shift and addition of the orthogonal transform coefficient within a predetermined frequency band.

9. (original) The additional information embedding method as claimed in claim 2, wherein the shift and addition step includes carrying out the shift and addition of the MDCT coefficient within a predetermined frequency band.

10. (original) The additional information embedding method as claimed in claim 1, wherein the shift and addition step includes dividing the frequency band of the audio signal and carrying out shift and addition for each of the divided frequency bands.

11. (original) The additional information embedding method as claimed in claim 10, wherein the shift and addition step includes reversing the shifting direction of the divided adjacent frequency bands.

12. (original) The additional information embedding method as claimed in claim 1, further comprising a step of scrambling the signal calculated by the shift and addition step, using a pseudo-random signal.

13. (original) The additional information embedding method as claimed in claim 2, wherein the shift and addition step includes shifting the MDCT coefficient toward the frequency-increasing side and adding the MDCT coefficient to the original MDCT coefficient.

14. (original) The additional information embedding method as claimed in claim 13, wherein at the shift and addition step, the frequency of the MDCT coefficient is increased by ((sampling frequency/number of samples of MDCT coefficient) x 2N) Hz, as the MDCT coefficient is shifted by 2N units (where N is a natural number).

15. (original) The additional information embedding method as claimed in claim 14, wherein the shift and addition step is substantially equal to the amplitude of the audio signal.

16. (original) The additional information embedding method as claimed in claim 2, wherein the shift and addition step includes shifting the MDCT coefficient toward the frequency-decreasing side and adding the MDCT coefficient to the original MDCT coefficient.

17. (original) The additional information embedding method as claimed in claim 16, wherein at the shift and addition step, the frequency of the MDCT coefficient is

decreased by ((sampling frequency/number of samples of MDCT coefficient) x 2N) Hz, as the MDCT coefficient is shifted by 2N units (where N is a natural number).

18. (original) The additional information embedding method as claimed in claim 17, wherein the shift and addition step is substantially equal to the amplitude of the audio signal.

19. (original) The additional information embedding method as claimed in claim 2, wherein the shift and addition step includes shifting the MDCT coefficient by 2N units (where N is a natural number).

20. (original) The additional information embedding method as claimed in claim 2, wherein the shift and addition step includes shifting the MDCT coefficient by 2N-1 units (where N is a natural number).

21. (original) The additional information embedding method as claimed in claim 2, wherein the shift and addition step includes adding the shifted MDCT coefficient within a critical band of a frequency masking area of the MDCT coefficient of the original audio signal.

22. (original) The additional information embedding method as claimed in claim 1, wherein the additional information is limitation information for prohibiting transfer of the audio signal.

23. (original) The additional information embedding method as claimed in claim 1, wherein the additional information is limitation information for prohibiting recording of the audio signal to a recording medium.

24. (original) The additional information embedding method as claimed in claim 1, wherein the additional information is work data corresponding to the audio signal.

25. (currently amended) An additional information embedding device for embedding additional information into an audio signal, the device comprising:

orthogonal transform means for orthogonally transforming an audio signal and thus calculating an orthogonal transform coefficient; and

shift and addition means for damping and shifting the orthogonal transform coefficient in the direction of the frequency axis and adding the ~~resultant coefficient~~ additional information to the original orthogonal transform coefficient ~~so as to embed the additional information~~;

wherein the shift and addition step generates the additional information by carrying out inverse orthogonal transform to a predetermined number of the orthogonal transform coefficient.

26. (currently amended) The additional information embedding device as claimed in claim 25, wherein the orthogonal transform means carries out MDCT of the audio signal so as to calculate an MDCT coefficient, and wherein the shift and addition means damps and shifts the calculated MDCT coefficient in the direction of the frequency axis and adds the

~~resultant coefficient~~ additional information to the original MDCT coefficient so as to embed the additional information.

27. (original) The additional information embedding device as claimed in claim 25, wherein the shift and addition means adds the orthogonal transform coefficient shifted on the frequency axis to the original orthogonal transform coefficient so that a frequency masking condition and a temporal masking condition are met.

28. (original) The additional information embedding device as claimed in claim 25, wherein the shift and addition means carries out the addition when the value obtained by adding the shifted orthogonal transform coefficient to the value of the original orthogonal transform coefficient is not higher than a predetermined value.

29. (original) The additional information embedding device as claimed in claim 25, wherein the shift and addition means prohibits the shift and addition in accordance with the polarity of the value obtained by adding the shifted orthogonal transform coefficient to the value of the original orthogonal transform coefficient.

30. (original) The additional information embedding device as claimed in claim 25, wherein the shift and addition means carries out the shift and addition when the audio signal falls within a range from an upper limit value to a lower limit value.

31. (original) The additional information embedding device as claimed in claim 30, wherein the shift and addition means carries out the shift and addition when the audio signal falls within a range from an upper limit value to a lower limit value set on the basis of the human auditory characteristics.

32. (original) The additional information embedding device as claimed in claim 25, wherein the shift and addition means carries out the shift and addition of the orthogonal transform coefficient within a predetermined frequency band.

33. (original) The additional information embedding device as claimed in claim 26, wherein the shift and addition means carries out the shift and addition of the MDCT coefficient within a predetermined frequency band.

34. (original) The additional information embedding device as claimed in claim 25, wherein the shift and addition means divides the frequency band of the audio signal and carries out shift and addition for each of the divided frequency bands.

35. (original) The additional information embedding device as claimed in claim 34, wherein the shift and addition means reverses the shifting direction of the divided adjacent frequency bands.

36. (original) The additional information embedding device as claimed in claim 25, further comprising means for scrambling the signal calculated by the shift and addition means, using a pseudo-random signal.

37. (original) The additional information embedding device as claimed in claim 26, wherein the shift and addition means shifts the MDCT coefficient toward the frequency-increasing side and adds the MDCT coefficient to the original MDCT coefficient.

38. (original) The additional information embedding device as claimed in claim 37, wherein at the shift and addition means, the frequency of the MDCT coefficient is increased by ((sampling frequency/number of samples of MDCT coefficient) x 2N) Hz, as the MDCT coefficient is shifted by 2N units (where N is a natural number).

39. (original) The additional information embedding device as claimed in claim 38, wherein the shift and addition means is substantially equal to the amplitude of the audio signal.

40. (original) The additional information embedding device as claimed in claim 26, wherein the shift and addition means shifts the MDCT coefficient toward the frequency-decreasing side and adds the MDCT coefficient to the original MDCT coefficient.

41. (original) The additional information embedding device as claimed in claim 40, wherein at the shift and addition means, the frequency of the MDCT coefficient is

decreased by ((sampling frequency/number of samples of MDCT coefficient) x 2N) Hz, as the MDCT coefficient is shifted by 2N units (where N is a natural number).

42. (original) The additional information embedding device as claimed in claim 41, wherein the shift and addition means is substantially equal to the amplitude of the audio signal.

43. (original) The additional information embedding device as claimed in claim 26, wherein the shift and addition means shifts the MDCT coefficient by 2N units (where N is a natural number).

44. (original) The additional information embedding device as claimed in claim 26, wherein the shift and addition means shifts the MDCT coefficient by 2N-1 units (where N is a natural number).

45. (original) The additional information embedding device as claimed in claim 26, wherein the shift and addition means adds the shifted MDCT coefficient within a critical band of a frequency masking area of the MDCT coefficient of the original audio signal.

46. (original) The additional information embedding device as claimed in claim 25, wherein the orthogonal transform means and the shift and addition means are integrally constituted.

47. (original) The additional information embedding device as claimed in claim 25, wherein the additional information is limitation information for prohibiting transfer of the audio signal.

48. (original) The additional information embedding device as claimed in claim 25, wherein the additional information is limitation information for prohibiting recording of the audio signal to a recording medium.

49. (original) The additional information embedding device as claimed in claim 25, wherein the additional information is work data corresponding to the audio signal.

50. (currently amended) A demodulation method for receiving an audio signal in which additional information generated by carrying out inverse orthogonal transform to a predetermined number of an orthogonal transform coefficient is embedded and demodulating the additional information, the method comprising:

a receiving step of receiving an audio signal in which additional information is embedded by damping and shifting in the direction of the frequency axis and adding to the audio signal on the original frequency axis; and

a demodulation step of demodulating the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

51. (currently amended) The demodulation method as claimed in claim 50, wherein the receiving step includes receiving the audio signal in which the additional information is embedded by damping and shifting in the direction of the frequency axis an orthogonal transform coefficient calculated by orthogonally transforming the audio signal and adding the ~~resultant orthogonal transform coefficient~~ additional information to the original orthogonal transform coefficient.

52. (original) The demodulation method as claimed in claim 51, wherein the receiving step includes receiving the audio signal in which the additional information is embedded by damping and shifting in the direction of the frequency axis an MDCT coefficient calculated by MDCT of the audio signal and adding the resultant MDCT coefficient to the original MDCT coefficient.

53. (original) The demodulation method as claimed in claim 50, wherein the receiving step includes receiving the audio signal in which the additional information is embedded by AM modulation, and wherein the demodulation step includes demodulating the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

54. (original) The demodulation method as claimed in claim 50, wherein the receiving step includes receiving the audio signal in which the additional information is embedded by FM modulation, and wherein the demodulation step includes demodulating the

additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

55. (original) The demodulation method as claimed in claim 50, wherein the receiving step includes receiving the audio signal in which the additional information is embedded by Hilbert conversion, and wherein the demodulation step includes demodulating the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

56. (original) The demodulation method as claimed in claim 50, wherein the demodulation step includes demodulating the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis within a predetermined frequency band of the received signal.

57. (original) The demodulation method as claimed in claim 50, wherein the additional information is control information for prohibiting transfer of the audio signal.

58. (original) The demodulation method as claimed in claim 50, wherein the additional information is control information for prohibiting recording of the audio signal to a recording medium.

59. (original) The demodulation method as claimed in claim 50, wherein the additional information is work data corresponding to the audio signal.

60. (currently amended) A demodulation device for receiving an audio signal in which additional information generated by carrying out inverse orthogonal transform to a predetermined number of an orthogonal transform coefficient is embedded and demodulating the additional information, the device comprising:

receiving means for receiving an audio signal in which additional information is embedded by damping and shifting in the direction of the frequency axis and adding to the audio signal on the original frequency axis; and

demodulation means for demodulating the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

61. (currently amended) The demodulation device as claimed in claim 60, wherein the receiving means receives the audio signal in which the additional information is embedded by damping and shifting in the direction of the frequency axis an orthogonal transform coefficient calculated by orthogonally transforming the audio signal and adding the ~~resultant orthogonal transform coefficient~~ additional information to the original orthogonal transform coefficient.

62. (original) The demodulation device as claimed in claim 61, wherein the receiving means receives the audio signal in which the additional information is embedded by damping and shifting in the direction of the frequency axis an MDCT coefficient calculated by

MDCT of the audio signal and adding the resultant MDCT coefficient to the original MDCT coefficient.

63. (original) The demodulation device as claimed in claim 60, wherein the receiving means receives receiving the audio signal in which the additional information is embedded by AM modulation, and wherein the demodulation means demodulates the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

64. (original) The demodulation device as claimed in claim 60, wherein the receiving means receives the audio signal in which the additional information is embedded by FM modulation, and wherein the demodulation means demodulates the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

65. (original) The demodulation device as claimed in claim 60, wherein the receiving means receives the audio signal in which the additional information is embedded by Hilbert conversion, and wherein the demodulation means demodulates the additional information on the basis of the polarity of the audio signal at each predetermined interval on the frequency axis, of the received signal.

66. (original) The demodulation device as claimed in claim 60, wherein the demodulation means demodulates the additional information on the basis of the polarity of the

audio signal at each predetermined interval on the frequency axis within a predetermined frequency band of the received signal.

67. (original) The demodulation device as claimed in claim 60, wherein the additional information is control information for prohibiting transfer of the audio signal.

68. (original) The demodulation method as claimed in claim 60, wherein the additional information is control information for prohibiting recording of the audio signal to a recording medium.

69. (original) The demodulation method as claimed in claim 60, wherein the additional information is work data corresponding to the audio signal.